(NASA-CR-150192) RELIABILITY PROGRAM PLAN FOR THE ELECTRONICS ASSEMBLY FOR THE HRUV SPECTROMETER/POLARIMETER INTENDED FOR THE SOLAR MAXIMUM MISSION (SCI Systems, Inc., Huntsville, Ala.) 27 p HC A03/MF A01

N77-18206

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RELIABILITY PROGRAM PLAN

FOR THE

ELECTRONICS ASSEMBLY

FOR THE

HRUV SPECTROMETER/POLARIMETER

INTENDED FOR THE

SOLAR MAXIMUM MISSION

SUBMITTED TO

MARSHALL SPACE FLIGHT CENTER

HUNTSVILLE, ALABAMA

NASA/MSFC CONTRACT NAS8-32035

REVISED

JANUARY 1977

SCI SYSTEMS, INC.

8600 SOUTH MEMORIAL PARKWAY

HUNTSVILLE, ALABAMA 35802

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FIGURES

1.0 INTRODUCTION

This document presents the Reliability Program Plan to be implemented on the HRUV Spectrometer/Polarimeter Electronics Assy Program at SCI Systems, Inc. This document is submitted for review by Marshall Space Flight Center (MSFC) as a data submittal for contract NAS8-32035.

This document will be the governing document for the reliability tasks to be accomplished during the program. This plan is in basic conformance to the requirements of NHB5300(1A), Reliability Program Provisions for Space System Contractors, and is intended to provide an effective guide towards achievement of the reliability requirements contained in GSFC Document SMM-300-01 Revision A.

2.0 APPLICABLE DOCUMENTS

The following documents form a part of this program plan to the extent specified herein.

GSFC SPECIFICATIONS

PPL 12	GSFC Preferred Parts List Number 12 (Notices 1 and 2)
SMM-300-01	Reliability and Quality Assurance Specification for SMM Instruments

NASA DOCUMENTS

NHB5300.4 (1A)	Reliability Program Provisions for Space System Contractors.

MILITARY DOCUMENTS

MIL-M-38510	Microcircuits, General Specification for
MIL-STD-975 (NASA)	Standard Parts List for Flight and Mission-Essential Ground Support Equipment
MIL-S-19500	Semiconductors, General Specification for

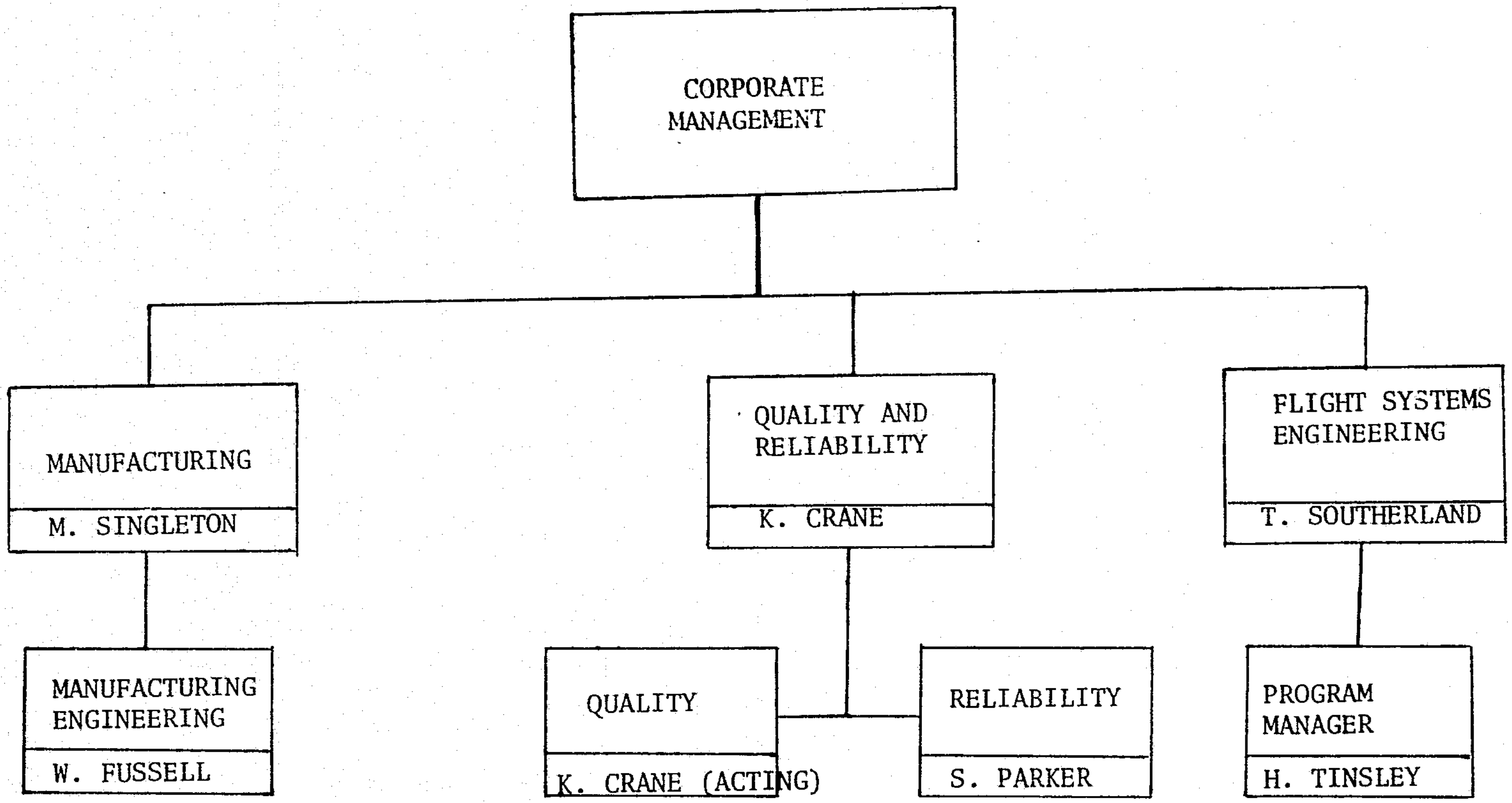
3.0 RELIABILITY MANAGEMENT

The reliability tasks required for the program will be conducted by the Reliability Engineering Section. The activities of this section are directed by a Reliability Supervisor who reports to the Quality and Reliability Assurance Manager. The Reliability Supervisor is charged with the responsibility of providing the Program Manager with specialized support in the reliability disciplines. This will then allow the Program Manager to comply with the program requirements in this specialty area without bearing the burden of detail involvement in the daily activities of the reliability efforts. This organization provides a single source of responsibility to enforce the reliability policies and the authority to ensure necessary actions consistent with the reliability program requirements.

In summary, the reliability function will be managed as to maintain the integrity of the hardware through the established disciplines of the reliability trade. This will assure the customer that the deliverable items will meet the mission requirements throughout their intended lifetime.

3.1 ORGANIZATION

Figure 3-1 indicates the administrative organization by which the reliability section will be governed in its relationship to the HRUV Spectrometer/Polarimeter Electronics Assembly Program. With the aid of this chart it is easily seen that the separate hierachy of program engineering and reliability are maintained. This arrangement provides a close functional relationship between the respective groups while providing the separate administrative paths required by charter.



SMM ELECTRONICS ASSEMBLY PROGRAM ORGANIZATION

FIGURE 3-1

3.2 RELIABILITY SECTION

The primary role of the Reliability Section is to provide direct assistance in the areas of reliability engineering, reliability analysis, component selection and component analysis. The department provides indirect support in the way of statistical evaluation of test results and trend evaluation. This particular operation insures that sufficient inter-program communication is maintained concerning the general performance and quality of the electronic hardware developed and produced by SCI Systems, Inc.

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In general, SCI's Reliability Section operates to fulfill the exacting analytical requirements of the applicable military and civilian aerospace programs. The experience gained on previous programs will allow the several tasks to be performed using the most recent component information available coupled with exacting electrical and mechanical designs.

3.3 PROGRAM REVIEW

MSFC and SCI representatives will jointly conduct formal reviews of the reliability program to assess its progress and effectiveness and to determine the need for adjustments or changes. These formal reviews will normally be conducted in conjunction with scheduled program design reviews.

These reviews will be in addition to the normal in-house program surveillance performed by the Reliability section.

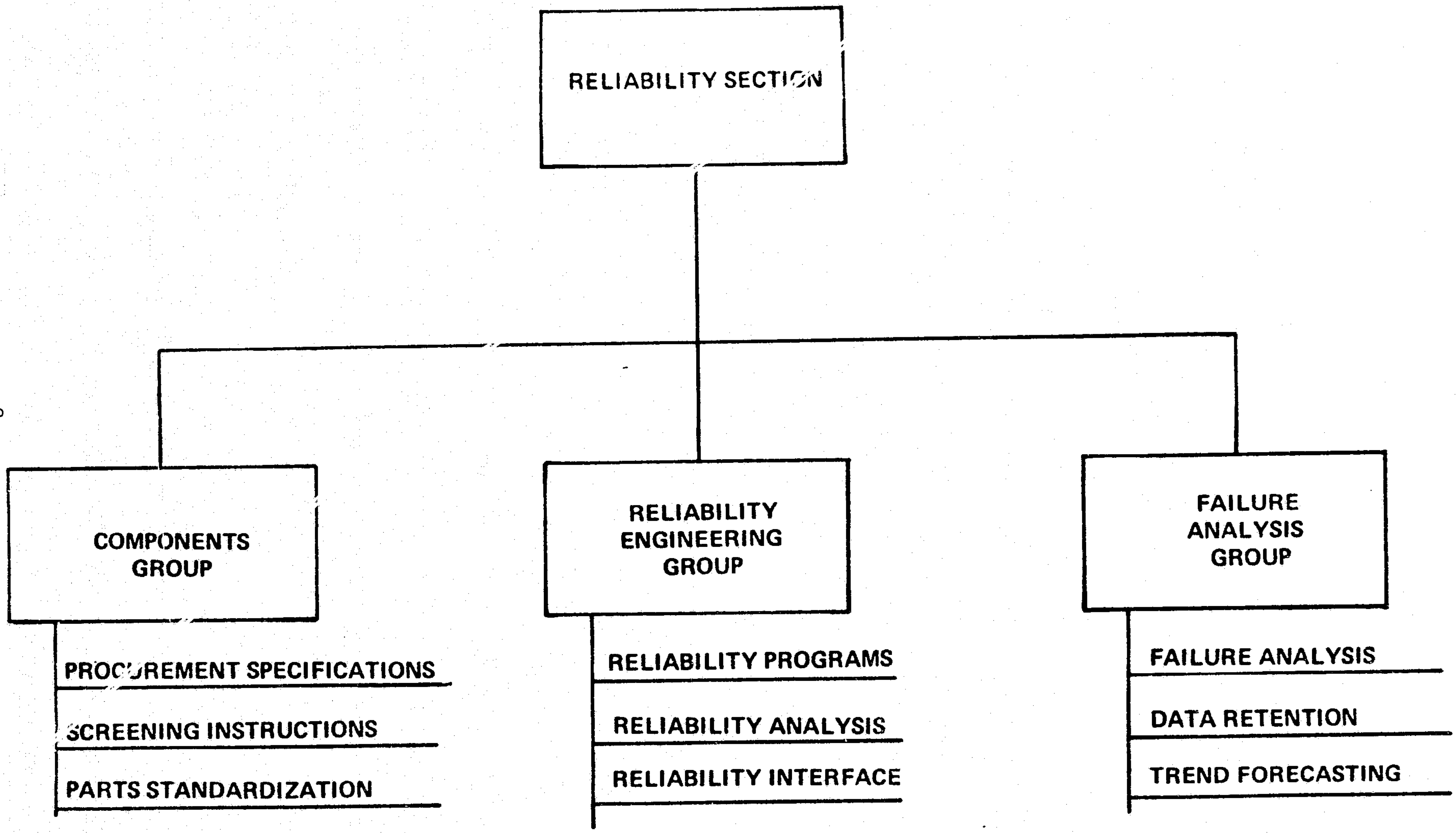

FIGURE 3-2

RELIABILITY SECTION FUNCTIONAL TASK CHART

3.4 SUPPLIER CONTROL

SCI will impose, and enforce by surveillance if required, specific reliability requirements upon suppliers of major procured items. The extent of requirements imposed by SCI will be based on the performance demands of the items, as well as, the degree of confidence previously established with the sources of these items. In all cases, procured items will be controlled by adequate military specification, NASA or SCI control drawings which insure the quality and reliability of the items used on the program. Supplier design review meetings will be required for development of major components and will satisfy the intent of GSFC Document No. SMM-300-01 Revision A. These design review meetings will include participation by MSFC and SCI representatives.

Modifications to existing supplier OSO-8 equipment will be evaluated for compatibility with the Electronics Assembly (ERA). Major modifications and/or additions will be controlled by design specifications which detail the performance demands of the Electronics Assembly. Appendix III of this plan presents the procedures used by SCI in preparation of component specifications.

4.0 PARTS STRESS ANALYSIS

In order to assure that part applications conform to derating ground rules and to determine part failure based on applied stresses, a Reliability Engineer will conduct a Parts Stress Analysis on all piece parts in circuits that have changed from the OSO-8 configuration and on all new hardware. A general description of procedures to be used in performing this analysis are as follows.

The initial step in any stress analysis is to identify the critical parameters associated with the failure of each type of component. These parameters then form the basis for identifying potential component problem areas. This is performed by making use of the recommended derating guides on which failure rates are based as well as review of part vendor specifications and part failure histories. The derating guidelines given in Appendix B of GFSC PPL 12 will be used for the ERA design.

After identification of the critical parameters of each type of component, the system components are listed on their appropriate work sheets by generic type and reference designators. The forms to be used for this purpose are included in the Appendix I of this plan. Critical parameters, as described above, are then entered under the appropriate section for each component.

Each component and parameter is then considered with the intent of insuring it cannot be overstressed under any circuit performance because of basic electrical laws. A few of the more useful laws are listed below.

(1) The peak voltage to any component cannot exceed the maximum differential source voltage of the component in the absence of energy storage elements (inductors, capacitors, etc.).

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In those cases where the derated maximum parameters can be insured as described above, the component's application is inherently reliable and affords the maximum life of operating components.

The enormous demands on circuit performance and optimization of packages dictate that some components must be operationally dependent. In these cases additional considerations must be made to insure they are within acceptable stress levels under all modes of operation.

After completion of the stress analysis as described above, the results will be summarized and reviewed to identify possible problem areas and corrective actions needed in view of the system requirements. It should be noted that this approach to a formal stress analysis is relatively free of measurement technique fallacies which might be encountered by other approaches and provides maximum identification of potential problem areas.

5.0 FAILURE MODE, EFFECT AND CRITICALITY ANALYSIS (FMECA)

SCI will conduct an FMECA down to the functional subassembly level on all units of the ERA that change from the OSO-8 configuration and all new hardware. These analyses will be conducted and maintained current throughout the design stage to determine the possible modes of failure which may be eliminated or minimized by design corrective action. The results of this analysis will be available for design reviews.

Since each FMECA is unique, procedures for performing FMECA must be flexible to the extent that they are effective and consistent with the severity of requirements on the equipment. The following paragraphs will present the general procedures used in performing this analysis on new designs at SCI. It is felt that these procedures provide enough definition to ensure effectiveness of the analysis without restricting the necessary flexibility.

5.1 SYSTEM LEVEL ANALYSIS

System level analysis must be initiated in the very early stages of design in order that abnormalities can be identified and necessary corrective action taken for achievement of effective system performance with the least amount of cost impact. In most cases this analysis is in progress on an informal basis during the proposal effort and prior to any contract award.

After contract award, a formal approach to FMECA is begun on the system level. This system level analysis provides the ground work for determining the need for additional and more detailed studies of sub-systems, assemblies, and components. In addition, this analysis provides a yard stick in assessing the achievement of

contractual requirements of system performance and determining the effect of design changes which might be incorporated from time to time.

The system level and associated additional studies are periodically reviewed to insure their applicability to present design and contractual requirements. Figure 5-1 is a typical form used for this analysis. The following paragraphs will present particular techniques used in completing this form.

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In the early stages of design the identification should be by functional description only with the addition of reference designators to each functional description as the equipment definition progresses.

5.3 DETERMINATION OF FAILURE EFFECTS

After proper identification of inputs and outputs, each will be entered on the work sheet and the possibility of internal secondary failures as a result of inadvertent shorted or open conditions will be considered. In addition to these considerations the system effect of loss of signal will be entered. Special considerations will be given when various modes of signal loss would result in significantly different effects. In these cases, failure modes will be itemized

FAILURE MODE, EFFECTS AND CRITICAL ANALYSIS WORK SHEET

DATE ______________

FOR ____

SHEET ______ OF ______

ITEM	FUNCTIONAL DESCRIPTION	REFERENCE DESIGNATIONS	FAILURE MODES AND EFFECTS	FREQUENCY OCCURRENCE	CRITICALITY FACTOR	COMBINED FACTOR	ADDITIONAL REFERENCE

Figure 5-1

for the function and separate effects will be identified.

5.4 CRITICALITY OF FAILURE

The effect of each failure mode on system performance must be considered. This will be done by assigning a criticality factor to each to reflect their effect on system operation. Those failures that reflect adverse system performance toward major mission goals will then be separately identified.

5.5 SUB-SYSTEM ANALYSIS

After a system level analysis has been formulated, the need for additional analysis can be identified and major emphasis can be placed on possible problem areas which have adverse effects on successful system performance or personnel safety. The techniques used to perform additional studies will vary with the nature of problems encountered. When the complex nature of the possible problems warrant, a detailed study will be performed on the subsystem level similar to that performed for system level analysis. In any event the analysis will identify all critical and most probable modes of failure.

6.0 STANDARDIZATION OF DESIGN PRACTICES

SCI will utilize existing design and processing practices, procedures and standards insofar as practicable, modifying them as necessary to meet the quality and reliability requirements of the program. In consideration of the reliability demands on this program, the component application and derating guide in Appendix II of this document will be used in equipment design.

Part types used on newly designed hardware will be chosen from the types already used on the OSO-8 hardware as much as possible for standardization of parts.

7.0 DESIGN REVIEW PROGRAM

SCI will plan, schedule and conduct equipment design reviews at the following program milestones.

(a) Pre-layout Review - At the formulation of design concept and prior to fabrication of any hardware.

(b) Pre-prototype Review - At the completion of detailed design and prior to fabrication of prototype hardware.

(c) Post-qualification Test Review - At the completion of qualification testing.

These design reviews will be attended by cognizant representatives of SCI and MSFC. Mutually agreed to design review minutes, including action items, will be provided the MSFC Program Manager.

8.0 MALFUNCTION REPORTING AND FAILURE ANALYSIS

The existing SCI failure reporting system will be utilized on the HRUV Program. Failures will be documented starting at the time of first power application at the subassembly level. All failures occurring during end-item testing at SCI will be formally reported to MSFC along with the results of failure analysis and corrective actions taken to prevent recurrence of the failure.

The failure analysis group is responsible for the failure analysis and the trend forecasting operations. The information made available by this group will allow the program office to maintain control over the reliability of the hardware from piece-part to finished end-item as it passes through the various manufacturing operations. An important task of the program manager is to maintain the integrity of the hardware through the production process. The analysis of in-process failures by this group provides company management with sufficient information so that additional resources may be allotted as required to maintain an orderly production flow. A closed loop failure reporting system will be utilized in this program. The cause of failure will be determined for each failure event after final assembly to allow timely corrective action to be initiated to prevent recurrence of similar problems. The following paragraph is a general description of the failure reporting system.

The reporting system is a joint operation of the Quality Assurance and Reliability Sections. The duties of the two groups are delegated so that each group performs the activities most closely associated with its primary program responsibilities In the case of a malfunction during acceptance testing the Quality Assurance representative obtains the initial data concerning the malfunction, drafts a formal report regarding the incident, and reports the event to the Reliability

Section. Representatives from these two groups (with participation by the associated design group as required) decide if a detail analysis of the malfunction is necessary. If such an analysis is required, the responsible group(s) will be asked to perform the analysis to determine the cause of the failure. This information is then utilized to establish corrective action to prevent similar problems with later items. The data made available by each analysis is stored in the Data Bank which is maintained by the Reliability Section. The information is coded so that modern data processing techniques can be utilized in analysis of the information. A copy of the form used as input to the data bank is shown in Figure 8-1 and the associated codes in Figure 8-2. As one can easily see, the information may be recalled in any grouping necessary to investigate similar problems. Figure 8-3 is the form used for initial failure notification.

SCI FORM NO. 840-178 (Rev. 11/74)

RELIABILITY FAILURE ANALYSIS FORM

REL. LOG NO.	1 – 5	REQUESTOR	6
FINAL ASSEMBLY	7 / 8 – 10	S/N	11 / 12 – 15
ASSEMBLY NO. 3	16 / 17 – 19	S/N	20 / 21 – 24
ASSEMBLY NO. 2	25 / 26 – 28	S/N	29 / 30 – 33
ASSEMBLY NO. 1	34 / 35 – 37	S/N	38 / 39 – 42

FRA NO.	43 – 50	PROGRAM	51
PART NO.	52 – 65		
SORT	66	Component Reference Desig.	67 – 70
DATE CODE	71 – 74		
DEVICE TYPE	75	MANUF.	76 / 77
FAILURE MODE	78 – 80		

EXTERNAL VISUAL

NO DEFECTS ☐ DEFECTIVE: SOLDER/WELD ☐ PACKAGE ☐ LEAD ☐
MARKING ☐ OTHER ☐

X – RAY

N/A ☐ NO DISCREPANCIES ☐ DISCREPANCY ☐

HERMETICITY

N/A ☐ GROSS ☐ PASS ☐ FAIL FINE ☐ PASS ☐ FAIL

ELECTRICAL TEST

N/A ☐ GOOD ☐ OPEN ☐ SHORT ☐ OUT OF SPEC. ☐ VIBRATION ☐ TEMP.__________

INTERNAL VISUAL

N/A ☐ NO DEFECTS ☐ FOREIGN MATERIAL ☐ BOND/WIRE FAILURE ☐ ELECTRICAL OVERSTRESS ☐
METALLIZATION DEFECT ☐ OTHER ☐

COMMENTS

FIGURE 8-1

REQUESTOR (6)

A- Acceptance Test Procedure (A.T.P)
B- Burn-In
C- Customer Returned Material (C.R.M.)
I- In Process Failure (I.P.F)
P- Pre- A.T.P.
Q- Quality Test Procedure (Q.T.P)
R- Reliability Test Procedure (R.T.P)

FAILURE MODE (78)

A-	No Entry	2-	VENDOR Manufacturing Irregularity
B-	Good		
C-	Open	3-	Mechanical Misalignment
D-	Short		
E-	Out of Tolerance	4-	
F-	Degraded	5-	Workmanship
G-	Cracked Element	6-	Improper Installation
H-	Unbonded Chip		
I-	Epoxy	7-	Secondary Failure
J-	Wire	8-	Trouble-Shooting
K-	Die Bond	9-	Poor Wetting
L-	Post Bond	*	SCI MANUFACTURING IRREGULARITY
M-	Beam Lead	/	
N-	External Lead	_	
O-	Chipout	,	
P-	Oxide Fault	)	
Q-	Hermeticity	(	
R-	Metalization	$	
S-	Contamination		
T-	Foreign Material	"	
U-	Electrical Overstress		
V-	Weld or Solder Connection		
W-	Wire Dress		
X-	Unknown Mechanism		
Y-	Broken Package		
Z-	Improper Removal		

DRAWING NO. (7) (16) (25) (34)

A-1995	Lockheed	I-1533	Titan
B-2595	"	J-3395	Titan
C-3344	"	K-3457	Hughes
D-1932	"	L-3631	F15
E-2532	"	M-2602	F15
F-3532	"	N-3895	Titan
G-2512	"	O-4044	F-15
H-3512	"	P-3604	F-15
		Q-	
		R-	

DEVICE TYPE (75)

Part Type

A- Relay
B- Board
C- Capacitor
D- Diode
E- Flex Cable
F- FET
G- Connector
H- Hybrid I.C.
I- Intergrated Circuit
J- Transformer
K- Crystal
L- Coil
M- Memory
R- Resistor
S- Switch
T- Transistor
U- Mechanical Component
V- Module
W- OPTO-Electronic Device

PROGRAM (51)

Same as Drawing Numbers.

SORT (66)

A- Starting 1 January 1975.

(65) WIRE/INTERCONNECT METALIZATION

A- AL/AL
B- Beam Lead
C- Gold/Al
D- Gold/Gold
E- AL/Gold Post
F- Gold/Gold Post

Z- Other

FIGURE 8-2

PROGRAM NUMBER ____________

ASSEMBLY FAILURE RECORD

FRA NUMBER ____________

TOP ASSEMBLY	DATE A1	OPERATOR A2	DESCRIPTION OF DEFECT/ISOLATION RESULTS A
	TEST SEQUENCE A3		
	ITEM NAME A4		
	PART NO. A5		NEXT OPERATION A
	SERIAL NO. A6		
ASSEMBLY NO. 3	DATE B1	OPERATOR B2	DESCRIPTION OF DEFECT/ISOLATION RESULTS B
	TEST SEQUENCE B3		
	ITEM NAME B4		
	PART NO. B5		NEXT OPERATION B
	SERIAL NO. B6		
ASSEMBLY NO. 2	DATE C1	OPERATOR C2	DESCRIPTION OF DEFECT/ ISOLATION RESULTS C
	TEST SEQUENCE C3		
	ITEM NAME C4		
	PART NO. C5		NEXT OPERATION C
	SERIAL NO. C6		
ASSEMBLY NO. 1	DATE D1	OPERATOR D2	DESCRIPTION OF DEFECT/ISOLATION RESULTS D
	TEST SEQUENCE D3		
	ITEM NAME D4		
	PART NO. D5		NEXT OPERATION D
	SERIAL NO. D6		

REPAIR RECORD

REPAIR LEVEL	DEFECTIVE ITEM TO BE REPLACED					NEW ITEM	APPROVAL		
	NAME	REF. DES.	PART NUMBER	S/N & D/C	APL NO	PRR NO.	QC	REL.	ENG.
A B C D									
A B C D									
A B C D									
A B C D									
A B C D									

RETEST RECORD

	DATE	OPERATOR	TEST SEQUENCE	ACCEPTED	REMARKS
D				YES NO	
	DATE	OPERATOR	TEST SEQUENCE	ACCEPTED YES NO	
	DATE	OPERATOR	TEST SEQUENCE	ACCEPTED YES NO	
	DATE	OPERATOR	TEST SEQUENCE	ACCEPTED YES NO	

CLOSURE ACTIONS

FIGURE 8-3

FINAL APPROVAL

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The primary role of the Reliability Section is to provide direct assistance in the areas of reliability engineering, reliability analysis, component selection and component analysis. The department provides indirect support in the way of statistical evaluation of test results and trend evaluation. This particular operation insures that sufficient inter-program communication is maintained concerning the general performance and quality of the electronic hardware developed and produced by SCI Systems, Inc.

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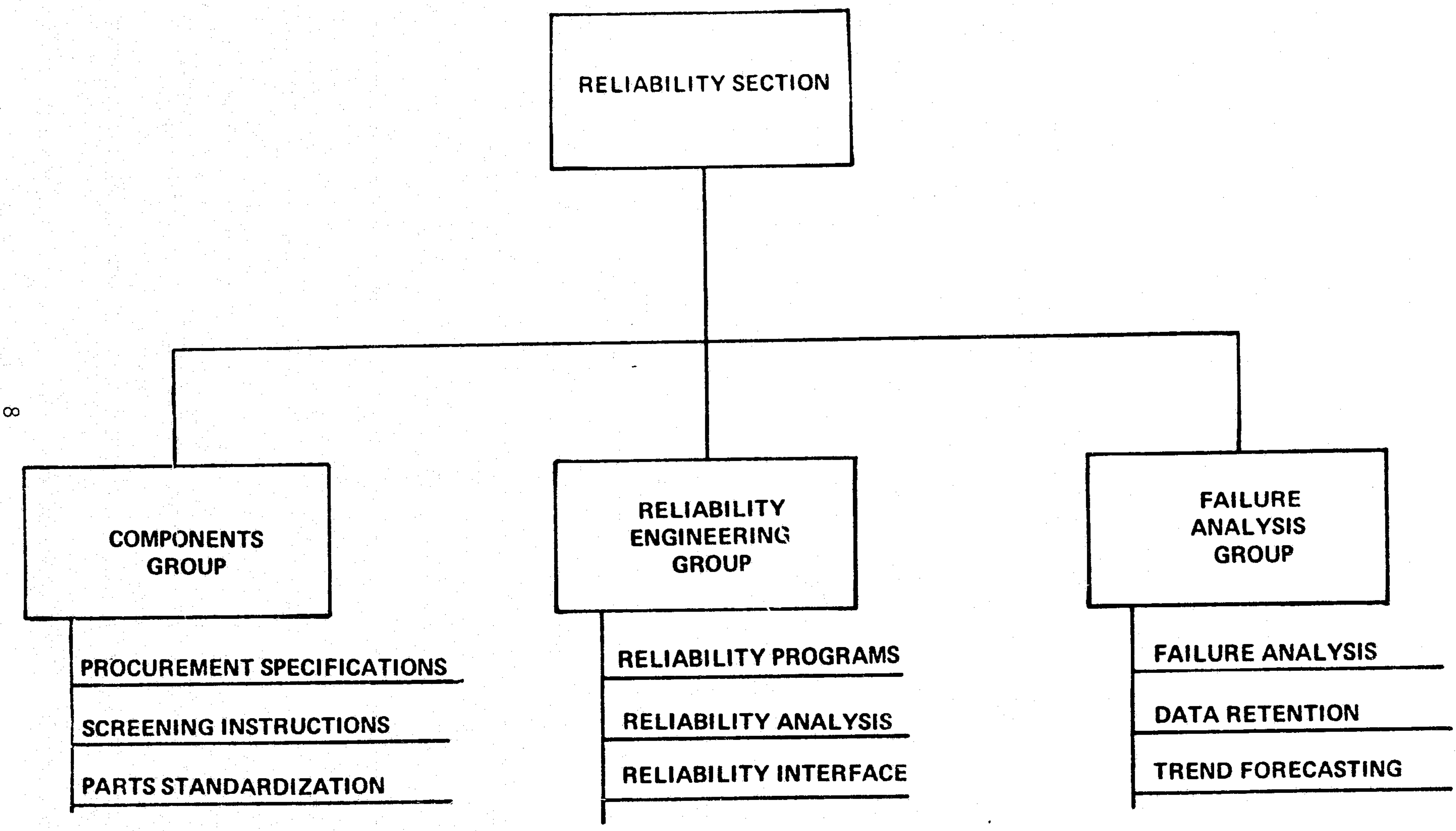

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RELIABILITY SECTION FUNCTIONAL TASK CHART

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SCI will impose, and enforce by surveillance if required, specific reliability requirements upon suppliers of major procured items. The extent of requirements imposed by SCI will be based on the performance demands of the items, as well as, the degree of confidence previously established with the sources of these items. In all cases, procured items will be controlled by adequate military specification, NASA or SCI control drawings which insure the quality and reliability of the items used on the program. Supplier design review meetings will be required for development of major components and will satisfy the intent of GSFC Document No. SMM-300-01 Revision A. These design review meetings will include participation by MSFC and SCI representatives.

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FAILURE MODE, EFFECTS AND CRITICAL ANALYSIS WORK SHEET

DATE ____________

FOR ______________________________________ SHEET _____ OF _____

ITEM	FUNCTIONAL DESCRIPTION	REFERENCE DESIGNATIONS	FAILURE MODES AND EFFECTS	FREQUENCY OCCURRENCE	CRITICALITY FACTOR	COMBINED FACTOR	ADDITIONAL REFERENCE

Figure 5-1

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8.0 MALFUNCTION REPORTING AND FAILURE ANALYSIS

The existing SCI failure reporting system will be utilized on the HRUV Program. Failures will be documented starting at the time of first power application at the subassembly level. All failures occurring during end-item testing at SCI will be formally reported to MSFC along with the results of failure analysis and corrective actions taken to prevent recurrence of the failure.

The failure analysis group is responsible for the failure analysis and the trend forecasting operations. The information made available by this group will allow the program office to maintain control over the reliability of the hardware from piece-part to finished end-item as it passes through the various manufacturing operations. An important task of the program manager is to maintain the integrity of the hardware through the production process. The analysis of in-process failures by this group provides company management with sufficient information so that additional resources may be allotted as required to maintain an orderly production flow. A closed loop failure reporting system will be utilized in this program. The cause of failure will be determined for each failure event after final assembly to allow timely corrective action to be initiated to prevent recurrence of similar problems. The following paragraph is a general description of the failure reporting system.

The reporting system is a joint operation of the Quality Assurance and Reliability Sections. The duties of the two groups are delegated so that each group performs the activities most closely associated with its primary program responsibilities In the case of a malfunction during acceptance testing the Quality Assurance representative obtains the initial data concerning the malfunction, drafts a formal report regarding the incident, and reports the event to the Reliability

Section. Representatives from these two groups (with participation by the associated design group as required) decide if a detail analysis of the malfunction is necessary. If such an analysis is required, the responsible group(s) will be asked to perform the analysis to determine the cause of the failure. This information is then utilized to establish corrective action to prevent similar problems with later items. The data made available by each analysis is stored in the Data Bank which is maintained by the Reliability Section. The information is coded so that modern data processing techniques can be utilized in analysis of the information. A copy of the form used as input to the data bank is shown in Figure 8-1 and the associated codes in Figure 8-2. As one can easily see, the information may be recalled in any grouping necessary to investigate similar problems. Figure 8-3 is the form used for initial failure notification.

SCI FORM NO. 840-178 (Rev. 11/74)

RELIABILITY FAILURE ANALYSIS FORM

REL. LOG NO. 1 5

REQUESTOR 6

FRA NO. 43 50

PROGRAM 51

FINAL ASSEMBLY 7 8 10 11 S/N 12 15

PART NO. 52 65

ASSEMBLY NO. 3 16 17 19 20 S/N 21 24

SORT 66

Component Reference Desig. 67 70

DATE CODE 71 74

ASSEMBLY NO. 2 25 26 28 29 S/N 30 33

ASSEMBLY NO. 1 34 35 37 38 S/N 39 42

DEVICE TYPE 75

MANUF. 76 77

FAILURE MODE 78 80

EXTERNAL VISUAL

NO DEFECTS ☐ DEFECTIVE: SOLDER/WELD ☐ PACKAGE ☐ LEAD ☐ MARKING ☐ OTHER ☐

X – RAY

N/A ☐ NO DISCREPANCIES ☐ DISCREPANCY ☐

HERMETICITY

N/A ☐

GROSS ☐ PASS ☐ FAIL

FINE ☐ PASS ☐ FAIL

ELECTRICAL TEST

N/A ☐ GOOD ☐ OPEN ☐ SHORT ☐ OUT OF SPEC. ☐ VIBRATION ☐ TEMP.__________

INTERNAL VISUAL

N/A ☐ NO DEFECTS ☐ FOREIGN MATERIAL ☐ BOND/WIRE FAILURE ☐ ELECTRICAL OVERSTRESS ☐ METALLIZATION DEFECT ☐ OTHER ☐

COMMENTS

FIGURE 8-1

REQUESTOR (6)

A- Acceptance Test Procedure (A.T.P)
B- Burn-In
C- Customer Returned Material (C.R.M.)
I- In Process Failure (I.P.F)
P- Pre- A.T.P.
Q- Quality Test Procedure (Q.T.P)
R- Reliability Test Procedure (R.T.P)

FAILURE MODE (78)

A-	No Entry	2-	VENDOR Manufacturing Irregularity
B-	Good		
C-	Open	3-	Mechanical Misalignment
D-	Short		
E-	Out of Tolerance	4-	
F-	Degraded	5-	Workmanship
G-	Cracked Element	6-	Improper Installation
H-	Unbonded Chip		
I-	Epoxy	7-	Secondary Failure
J-	Wire	8-	Trouble-Shooting
K-	Die Bond	9-	Poor Wetting
L-	Post Bond	*	SCI MANUFACTURING IRREGULARITY
M-	Beam Lead	/	
N-	External Lead	_	
O-	Chipout	,	
P-	Oxide Fault	)	
Q-	Hermeticity	(	
R-	Metalization	$	
S-	Contamination		
T-	Foreign Material	"	
U-	Electrical Overstress		
V-	Weld or Solder Connection		
W-	Wire Dress		
X-	Unknown Mechanism		
Y-	Broken Package		
Z-	Improper Removal		

DRAWING NO. (7) (16) (25) (34)

A-1995	Lockheed	I-1533	Titan
B-2595	"	J-3395	Titan
C-3344	"	K-3457	Hughes
D-1932	"	L-3631	F15
E-2532	"	M-2602	F15
F-3532	"	N-3895	Titan
G-2512	"	O-4044	F-15
H-3512	"	P-3604	F-15
		Q-	
		R-	

DEVICE TYPE (75)

Part Type

A- Relay
B- Board
C- Capacitor
D- Diode
E- Flex Cable
F- FET
G- Connector
H- Hybrid I.C.
I- Intergrated Circuit
J- Transformer
K- Crystal
L- Coil
M- Memory
R- Resistor
S- Switch
T- Transistor
U- Mechanical Component
V- Module
W- OPTO-Electronic Device

PROGRAM (51)

Same as Drawing Numbers.

SORT (66)

A- Starting 1 January 1975.

(65) WIRE/INTERCONNECT METALIZATION

A- AL/AL
B- Beam Lead
C- Gold/Al
D- Gold/Gold
E- AL/Gold Post
F- Gold/Gold Post

Z- Other

FIGURE 8-2

NE 11000

PROGRAM NUMBER ______

ASSEMBLY FAILURE RECORD

FRA NUMBER ______

TOP ASSEMBLY

DATE A1	OPERATOR A2	DESCRIPTION OF DEFECT/ISOLATION RESULTS	A
TEST SEQUENCE A3			
ITEM NAME A4			
PART NO. A5		NEXT OPERATION	A
SERIAL NO. A6			

ASSEMBLY NO. 3

DATE B1	OPERATOR B2	DESCRIPTION OF DEFECT/ISOLATION RESULTS	B
TEST SEQUENCE B3			
ITEM NAME B4			
PART NO. B5		NEXT OPERATION	B
SERIAL NO. B6			

ASSEMBLY NO. 2

DATE C1	OPERATOR C2	DESCRIPTION OF DEFECT/ ISOLATION RESULTS	C
TEST SEQUENCE C3			
ITEM NAME C4			
PART NO. C5		NEXT OPERATION	C
SERIAL NO. C6			

ASSEMBLY NO. 1

DATE D1	OPERATOR D2	DESCRIPTION OF DEFECT/ISOLATION RESULTS	D
TEST SEQUENCE D3			
ITEM NAME D4			
PART NO. D5		NEXT OPERATION	D
SERIAL NO. D6			

REPAIR RECORD

REPAIR LEVEL	DEFECTIVE ITEM TO BE REPLACED					NEW ITEM	APPROVAL		
	NAME	REF. DES.	PART NUMBER	S/N & D/C	APL NO	PRR NO.	QC	REL.	ENG.
A B C D									
A B C D									
A B C D									
A B C D									
A B C D									

RETEST RECORD

	DATE	OPERATOR	TEST SEQUENCE	ACCEPTED	REMARKS
D	DATE	OPERATOR	TEST SEQUENCE	ACCEPTED YES NO	
	DATE	OPERATOR	TEST SEQUENCE	ACCEPTED YES NO	
	DATE	OPERATOR	TEST SEQUENCE	ACCEPTED YES NO	
	DATE	OPERATOR	TEST SEQUENCE	ACCEPTED YES NO	

CLOSURE ACTIONS

FIGURE 8-3

FINAL APPROVAL

Q. C.	REL.	ENG.

SCI FORM NO. 810-114 (Rev. 11/74)

9.0 PARTS AND MATERIALS PROGRAM

SCI will, as a general policy, select parts for the system on the basis of proven qualification of each part and material for its application(s) and select them from sources employing effective reliability and quality programs in their manufacture. Every effort will be made to choose items already qualified to pertinent specifications and to use the minumum practicable number of styles of each generic type. When selecting items previously qualified. SCI will devote particular attention to currentness of data, applicability of basis of qualification, and adequacy of specifications.

The drawings, specifications, and procedures required to properly implement this program will be drawn from existing SCI documentation files wherever possible. These documents will be reviewed to make certain that they are adequate for the intended purpose. In situations where the existing documentation is inadequate, special supplements or new procedures will be written. Where applicable, the documentation will be placed under formal control.

The GSFC Preferred Parts List (PPL) will be used as a guide for selection of new parts on the HRUV program. A parts list, materials list and process list will be maintained and submitted to the MSFC Program Manager for SMM Project approval. New design will utilize part types already used on the OSO-8 hardware, as much as possible, to make use of parts already on hand from that program, but only after approval for use in SMM hardware has been given by the MSFC Program Manager for the SMM Project.

SCI will impose screening requirements on all parts used in the fabrication of flight hardware. Inventory on hand from the previous contract for OSO-8 hardware must be approved by the MSFC Program Manager for the SMM Project prior to use in flight hardware. This screening will be performed as an integral part of the testing performed by the manufacturer, or during part screening at SCI prior to installation into equipment. Figure 9-1 presents the screening matrix intended for use on flight hardware components.

	Pre Cap Visual	Visual	Electrical	Power Conditioning	Electrical	Temp Cycle	Electrical	Hi Temp Aging	Fine Leak	Gross Leak	Acceleration	Electrical	X-Ray	Electrical	Hi Temp Rev Bias	Electrical	Burn-In	Electrical	Short Time Overload	Electrical	Visual
Integrated Circuit (Linear)	X	X	X			X			X	X	X		X			X	X	X			X
Integrated Circuit (Digital)	X	X	X			X			X	X	X		X	X	X	X	X	X			X
Transistors		X	X			X		X	X	X	X		X	X	X	X	X	X			X
Diodes		X	X			X		X	X	X			X			X	X	X			X
Capacitors (Ceramic)		X	X			X							X				X	X			X
Capacitors (Mica)		X	X										X				X	X			X
Capacitors (Tantalum)		X	X			X							X				X	X			X
Inductor		X	X			X		X										X			X
Crystal		X	X			X			X	X			X					X			X
Resistor (Film)		X	X	X	X	X	X										X	X			X
Resistor (Wire Wound)		X	X			X	X					X	X				X	X	X	X	X
Resistor (Comp)		X	X														X	X			X
Thermistor		X	X			X											X	X			X

NOTE: Screening will be performed as applicable in the sequence shown from left to right according to the appropriate SCI in-house screening instruction and/or SCI procurement specification.

FIGURE 9-1

10.0 EQUIPMENT LOGS

SCI will maintain complete equipment status logs on the equipment in compliance with configuration management requirements. Each log will be identified to the equipment to which it pertains and will be maintained in chronological order and account for all periods of time including idle periods and any movements of the item. Entries will be complete, self-explanatory, and include the following:

a. Date and time of entry.

b. Identity of test or inspection.

c. Environmental conditions.

d. Characteristics being investigated.

e. Parameter measurements.

f. Complete identification of instrumentation used including serial number and calibration date.

g. Failure observations and failure report reference.

h. Accumulated operating time.

i. Cumulative number of duty cycles to date.

j. Discrepancies between the item tested and pertinent specifications or drawings.

k. Repair and maintenance record.

l. Record of pertinent, unusual or questionable occurrences involving the equipment.

m. Action taken to have "quick fixes" in test formalized as design changes.

n. Identity of individual making entry.

11.0 RELIABILITY REPORTING

Monthly reports on the status of reliability activities will be prepared by SCI for transmittal to MSFC as a part of the Monthly Product Assurance Status Report.

Reports will include, but not be limited to, the following sections:

1. Technical Progress - Significant achievements that occurred within the reporting period, the cumulative status of the reliability effort versus the scheduled program, etc.

2. Review of Significant Events - Comments on the major design changes and their effect on reliability; analysis of significant failures occurring during the reporting period; discussion of current and/or anticipated reliability problem areas, with recommendations for solution, etc.

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